tion between chondriosomes and plastids, MOTTIER[5] has brought the literature up to 1918.

LA VALETTE ST. GEORGE, working upon the male cells of insects, gave the first description of chondriosomes. He introduced the term cytomicrosomes. MEVES, in 1904, gave the first description for plants, using the tapetal cells of anthers of *Nymphaea* for material. LEWITSKI, in 1910, was first to claim that chondriosomes give rise to plastids. A little later he made a comparative study upon living and fixed material, showing conclusively that the bodies are present in living cells. The investigation by MOTTIER, to which reference has already been made, proves that some chondriosomes give rise to chloroplasts and leucoplasts. He also believes that the chondriosomes are permanent organs of the cell, of equal rank with the nucleus. Of course he recognizes that chloroplasts and leucoplasts also multiply by division. His claim that chondriosomes are concerned in the transmission of hereditary characters does not seem to be so well supported. Some investigators have suggested that chondriosomes transmit characters of the cytoplasm and that the chromosomes transmit characters of the nucleus.

It seems to be established that chondriosomes are not artifacts, that they multiply by division, and that some of them give rise to plastids. Their rôle in heredity, if they have any, still remains to be demonstrated.—C. J. CHAMBERLAIN.

Trimorphism of Pontederia.—The family Pontederiaceae is notable as containing the only known heterostyled species among monocotyledons (with possibly one exception), and is further remarkable among heterostyled plants as furnishing the only recorded examples of distinctly zygomorphic flowers in such plants. HAZEN[6] has recently published interesting observations on *Pontederia cordata* L. LEGGETT had reported in 1875 that this species was trimorphic, and the present paper is a detailed study of the flower forms, pollination, insect visitors, etc.

The tubular perianth is slightly zygomorphic and in all 3 flower forms presents 2 sets of stamens: a longer set of 3 on the anterior side of the flower, and 3 short-stalked stamens on the posterior side of the flower. In 2 of the flowers the upper stamens protrude beyond the open perianth. The long-styled stigma reaches a height of 12–13.5 mm., the mid-styled form 7–8 mm., and the short-styled form 3–3.5 mm. above the base of the ovary. The ratios of the average heights of the 3 lengths of pistils are approximately as 100, 60, and 22.

While the arrangement of parts is different in each of the 3 flower forms, it results in 2 sets of stamens adjusted to each length of pistil. The 6 legitimate crosses which may take place between the 6 sets of stamens and the 3 different

[5] MOTTIER, D. M., Chondriosomes and the primordia of chloroplasts and leucoplasts. Ann. Botany 32:191–214. *pl. 1.* 1918.

[6] HAZEN, TRACY E., The trimorphism and insect visitors of *Pontederia*. Mem. Torr. Bot. Club 17:459–484. 1918.

pistils are such that each flower type may be pollinated by either of the other 2 flower forms. Moreover, the flowers are placed on the axis of the spike so nearly horizontal as to lessen the probability of self-pollination.

The microspores are ellipsoidal in form and the different sets of stamens show marked differences in size of pollen grains, the higher anthers having the larger pollen, the middle ones intermediate, and the short-stalked stamens the smallest spores. This relation suggests a correspondence with the 3 types of stigmas. Averaging a large number of spores it was found that the mean diameters of the 3 sizes of pollen grains were as 100, 80, and 51, and their volumes respectively as 100, 53, and 14. Recalling HALSTED's work on *Eichhornia crassipes*, in which he found that all sizes of pollen grains germinated if given sufficient time, but that the larger spores germinated much more promptly than the smaller, HAZEN suggests that prompt germination would be of great advantage in the long-styled *Pontederia* flowers in which the flowers wither so quickly that a slow germinating spore might not have time to function.

The author lists observed insect visitors, naming 10 Lepidoptera and 4 Hymenoptera, the least skipper, *Ancyloxypha numitor* Fabr., being the most frequent visitor. Experimental work by the author is in progress on the relative fertility of the different flowers with various pollen combinations, and its publication is awaited with interest.—R. B. WYLIE.

Phototropism.—Miss PARR,[7] working in HOTTES' laboratory of the University of Illinois, has done an excellent piece of quantitative work on the response of *Pilobolus* to light. The literature on phototropism has been full of conflicting statements and theories, very largely due to the lack of quantitative work of the type done by Miss PARR. This work does much to show the reasons for these diverse views and to lay the foundations for substantial progress. The physics department of the University assisted in the control of the delicate instruments used in the measurements of light. It is very desirable at this stage of plant physiology that we get the more general cooperation of well-trained physicists and chemists to aid in transforming plant physiology from a qualitative to a quantitative science. The results of the work can best be presented by quoting the summary: (1) *Pilobolus* responds to the light of all regions of the visible spectrum; (2) the presentation time decreases gradually from red to violet, and there is no indication of intermediate maxima and minima; (3) the presentation time does not vary in direct ratio with the measured value of the energy of the light in the different regions of the spectrum; (4) the presentation time varies in inverse ratio to the square roots of the wave-frequency; (5) the product of the square root of the frequency times the presentation time decreases with the decrease in the energy value of the spectral regions and is an approximate constant for a given light source; (6) the spectral energy in its relation to presentation time may be expressed approximately in

[7] PARR, ROSALIE, Response of *Pilobolus* to light. Ann. Botany 32:177–205. 1918.